Amendments to the Claims:

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims:

1. (Currently Presented) A mass spectrometer comprising:

means (1) for generating ions from a sample introduced into a plasma;

a sampling aperture (2) for transmitting some of the ions into an evacuated expansion chamber (3) along a first axis (9) to form an ion beam;

a second aperture (5) for transmitting some of the ion beam into a first evacuated chamber (6);

a first pump (7) for maintaining the first evacuated chamber (6) at high vacuum;

a first ion optical device (17) located in the first evacuated chamber (6) for containing the ion beam wherein the first ion optical device (17) is a mass selective device;

a third aperture (19) for transmitting the ion beam into a second evacuated chamber (20);

a second pump (21) for maintaining the second evacuated chamber (20) at a lower pressure than the first evacuated chamber (6);

a collision cell (24) having an entrance aperture (27) and an exit aperture (28) and pressurized with a target gas (26) , the collision cell (24) being disposed in the second evacuated chamber (20);

a second ion optical device (25) located in the collision cell (24) for containing the ion beam;

a fourth aperture (32) for transmitting the ion beam into a third evacuated chamber (33) containing mass-to-charge ratio analyzing means (37) disposed along a second axis (36), wherein the mass-to-charge analyzing means is configured to mass analyze the ion beam to produce a mass spectrum of the ion beam such that both the first ion optical device (17) and the mass-to-charge ratio analyzing means (37) operate at the same mass to charge ratio;

a third pump (39) for maintaining the third evacuated chamber (33) at lower pressure

than the second evacuated chamber (20).

2. (Original) A mass spectrometer according to claim 1, wherein the first evacuated chamber (6) is maintained at a pressure of approximately 10^{-2} to 10^{-4} mbar.

3. (Previously Presented) A mass spectrometer according to claim 1, wherein the first evacuated chamber (6) is maintained at a pressure of approximately l-2 x 10^{-3} mbar.

4. (Previously Presented) A mass spectrometer according to claim 1, including a gap of at least 2 cm between the third aperture (19) and the entrance aperture (27) of the collision cell (24).

5. (Previously Presented) A mass spectrometer according to claim 1, wherein the distance between the ion source (1) and the entrance aperture (27) of the collision cell (24) is 90 to 200 mm.

6. (Previously Presented) A mass spectrometer according to claim 1, wherein the mass-to-charge ratio analyzing means (37) includes a main mass filter which preferably is an RF quadrupole.

7. (Cancelled)

8. (Previously Presented) A mass spectrometer according to claim 1, wherein the first ion optical device (17) is an RF quadrupole.

9. (Previously Presented) A mass spectrometer according to claim 1, wherein the second ion optical device (25) is an RF quadrupole.

10. (Previously Presented) A mass spectrometer according to claim 1, wherein the second ion optical device (25) is mass selective.

11. (Previously Presented) A mass spectrometer according to claim 1, wherein the second axis (36) of the mass to charge ratio analyzing means (37) is offset from the first axis (9).

12. (Previously Presented) A mass spectrometer according to claim 1, wherein the first evacuated chamber (6) is divided into a first region (14) adjacent to the expansion chamber containing an extractor lens (8) driven at a negative potential, and a second region (15) adjacent to the collision cell (24) in which the ion optical device (17) is located, by a large diameter aperture (11) and the aperture is sealable by means of a flat plate (12) on an O-ring seal (13).

13. (Previously Presented) A method of operating a mass spectrometer that incorporates a collision cell pressurized with a target gas, the method comprising:

generating, from an ion source, an ion beam including analyte ions and artifact ions;

mass selecting at least a portion of the ion beam at an analyte mass to charge ratio;

transmitting at least a portion of the mass selected ion beam into the collision cell;

transmitting at least a portion of the ion beam from the collision cell to a mass analyzer; and

mass analyzing at least a portion of the ion beam in the mass analyzer at the analyte mass to charge ratio.

14. (Previously Presented) A method according to claim 13, wherein the mass selecting is achieved by passing the ion beam through a first mass selective ion optical device.

15. (Previously Presented) A method according to claim 14, wherein the first mass

selective ion optical device is located in a first evacuated chamber maintained at high vacuum.

16. (Previously Presented) A method according to claim 15, wherein the collision cell is located in a second evacuated chamber operated at lower pressure than the first evacuated chamber, the ion beam being contained in the second evacuated chamber by a second ion optical device.

17. (Previously Presented) A method according to claim 15, wherein the first evacuated chamber is maintained at a pressure of approximately 10^{-2} to 10^{-4} mbar.

18. (Previously Presented) A method according to claim 15, wherein the first evacuated chamber is maintained at a pressure of approximately l-2 x 10^{-3} mbar.

19. (Previously Presented) A method according to claim 16, further comprising transmitting at least a portion of the ion beam from the ion source through a sampling aperture into an evacuated expansion chamber along a first axis, into the first evacuated chamber through a second aperture;

wherein transmitting at least a portion of the mass selected ion beam into the collision cell includes transmitting at least a portion of the ion beam into the second evacuated chamber through a third aperture, wherein a gap of at least 2 cm is maintained between the third aperture and an entrance aperture of the collision cell.

20. (Previously Presented) A method according to claim 13, wherein a distance of 90 to 200 cm is maintained between the ion source and an entrance aperture of the collision cell.

21. (Previously Presented) A method according to claim 19, wherein the mass analyzer is located in a third evacuated chamber operated at lower pressure than the second

evacuated chamber, the mass analyzer being disposed along a second axis.

22. (Previously Presented) A method according to claim 14, wherein the first mass selective ion optical device is an RF quadrupole.

23. (Previously Presented) A method according to claim 16, wherein the second ion optical device is an RF quadrupole.

24. (Previously Presented) A method according to claim 16, wherein the second ion optical device is mass selective.

25. (Previously Presented) A method according to claim 15, wherein the first evacuated chamber is divided into a first region adjacent to the expansion chamber containing an extractor lens driven at a negative potential, and a second region adjacent to the collision cell, by a large diameter aperture and the aperture is sealable by means of a flat plate on an O-ring seal.

26. (Previously Presented) A method according to claim 21, wherein the second axis is offset from the first axis.

27. (Previously Presented) A mass spectrometer comprising:

an ion source for generating an ion beam from a sample introduced into a plasma;

an ion optical device disposed to receive at least a portion of an ion beam generated by the ion source, the ion optical device being configured to mass select at least a portion of the ion beam generated by the ion source at a mass-to-charge ratio;

a collision cell disposed to receive at least a portion of a mass selected ion beam from the ion optical device; and

a mass analyzer disposed to receive at least a portion of the mass selected ion beam from the collision cell, the mass analyzer being configured to mass analyze the received ion beam at the mass-to-charge ratio.

28. (New) A mass spectrometer, comprising:

an ion source for generating an ion beam from a sample introduced into a plasma, the beam containing unwanted gas components and artifact ions;

a collision cell within an evacuation chamber, the collision cell being disposed to receive at least a portion of the ion beam from the ion source and arranged to be pressurized with a target gas for removing unwanted artifact ions from the ion beam in the collision cell;

an ion optical device configured upstream of the collision cell to reduce gas loading from the ion source on the collision cell; and

a mass-to-charge ratio analyzer disposed within an analyzing chamber and arranged to receive at least a portion of the ion beam from the collision cell and to mass analyze the received ion beam to produce a mass spectrum of the received ion beam.

29. (New) The mass spectrometer of claim 28, further comprising an ion transmission-enhancing device, the ion transmission-enhancing device comprising the ion optical device.

30. (New) The mass spectrometer of claim 28, wherein the ion optical device comprises a quadrupole, multipole, ion guide, ion lens or sector.

31. (New) The mass spectrometer of claim 30, wherein the ion optical device comprises a magnetic sector.

32. (New) The mass spectrometer of claim 28, wherein the ion optical device is mass-selective.

33. (New) The mass spectrometer of claim 28, further comprising a sampling aperture configured for transmitting some of the ions from the ion source into an evacuated expansion chamber upstream of the ion optical device.

34. (New) The mass spectrometer of claim 33, further comprising an aperture for transmitting some of the ion beam from the expansion chamber into the evacuation chamber.

35. (New) The mass spectrometer of claim 28, wherein ions of the ion beam are transmitted through the ion optical device along an axis.

36. (New) The mass spectrometer of claim 35, wherein neutral gas of the unwanted gas components diverges from the axis at the ion optical device.

37. (New) The mass spectrometer of claim 35, wherein the ion beam is deflected off the axis upstream of the mass-to-charge analyzer.

38. (New) The mass spectrometer of claim 28, wherein the ion beam includes a portion in which ions are transmitted along an axis, and the ion beam is deflected off the axis upstream of the mass-to-charge analyzer.

39. (New) The mass spectrometer of claim 38, further comprising a deflector to deflect the ion beam off the axis upstream of the mass-to-charge analyzer.

40. (New) The mass spectrometer of claim 39, wherein the deflector comprises a double deflector.

41. (New) The mass spectrometer of claim 39, wherein the deflector comprises an electrostatic sector.

42. (New) The mass spectrometer of claim 41, wherein the electrostatic sector comprises two cylindrical electrostatic sectors in series.

43. (New) The mass spectrometer of claim 38, wherein the ion beam is deflected off the axis downstream of the collision cell.

44. (New) The mass spectrometer of claim 28, wherein the ion beam passes along a path and neutral gas of the unwanted gas components diverges from the path.

45. (New) The mass spectrometer of claim 28, wherein the ion optical device is configured such that the at least a portion of the ion beam received by the collision cell is substantially free of neutral gas components from the ion source.

46. (New) The mass spectrometer of claim 28, further comprising an ion optical device disposed within the collision cell, the ion optical device configured for containing the ion beam as it passes through the collision cell.

47. (New) The mass spectrometer of claim 28, further comprising a first pump for maintaining the evacuation chamber at a first vacuum pressure, and a second pump for maintaining the analyzing chamber at a second vacuum pressure.

48. (New) The mass spectrometer of claim 28, further comprising an intermediate evacuation chamber in which the ion optical device is disposed.

49. (New) The mass spectrometer of claim 48, further comprising a first pump for maintaining the intermediate evacuation chamber at a first vacuum pressure, and a second pump for maintaining the evacuation chamber at a second vacuum pressure lower than the first vacuum pressure.

50. (New) A method of operating a mass spectrometer, the method comprising the steps of:

generating at an ion source an ion beam from a sample, the beam containing unwanted gas components and artifact ions from the ion source;

reducing gas loading from the ion source on a collision cell, the reducing occurring upstream of the collision cell;

pressurizing the collision cell with a target gas for removing unwanted artifact ions from the ion beam in the collision cell;

receiving in the collision cell at least a portion of the ion beam substantially free of neutral gas components from the ion source; and

receiving at least a portion of the ion beam from the collision cell in a mass-to-charge ratio analyzer.

51. (New) The method of claim 50, wherein reducing gas loading comprises passing the ion beam through a transmission enhancing device.

52. (New) The method of claim 51, wherein reducing gas loading comprises transmitting ions of the ion beam through the transmission enhancing device along a first axis.

53. (New) The method of claim 51, wherein reducing gas loading comprises diverging neutral gas of the unwanted gas components from the first axis.

54. (New) The method of claim 51, further comprising transmitting some of the ions from the ion source through a sampling aperture into an evacuated expansion chamber upstream of the transmission enhancing device.

55. (New) The method of claim 51, wherein the ion transmission enhancing device is located within an intermediate evacuation chamber, the collision cell is located within an evacuation chamber, and the method includes evacuating the intermediate evacuation chamber to a first vacuum pressure, evacuating the evacuation chamber to a second vacuum pressure that is lower than the first pressure.

56. (New) The method of claim 50, wherein the collision cell is located within an evacuation chamber, the mass-to-charge ratio analyzer is located within an analyzer chamber, and the method includes evacuating the evacuation chamber to a first vacuum pressure, evacuating the analyzer chamber to a second vacuum pressure that is lower than the first pressure.

57. (New) The method of claim 50, wherein the ion beam includes a portion in which ions are transmitted along an axis, and the method comprises deflecting the ion beam off the axis upstream of the mass-to-charge analyzer.

58. (New) The method of claim 57, wherein deflecting the ion beam includes electrostatically deflecting the ion beam.

59. (New) The method of claim 57, wherein deflecting the ion beam includes twice deflecting the ion beam.

60. (New) The method of claim 57, wherein the ion beam is deflected off the axis downstream of the collision cell.

61. (New) The method of claim 50, wherein the ion beam passes along a path and neutral gas of the unwanted gas components diverges from the path.